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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2013/042

Newfoundland and Labrador Region

Proceedings of the Newfoundland and Labrador Regional Advisory Process on the status of Capelin in Subarea (SA) 2 and Divisions 3KL in 2013

January 29-30, 2013
St. John's, NL

Meeting Chairperson: Earl Dawe
Editor: James Meade

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December 2013

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

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ISSN 1701-1280

Correct citation for this publication:

DFO. 2013. Proceedings of the Newfoundland and Labrador Regional Advisory Process on the status of Capelin in Subarea (SA) 2 and Divisions 3KL in 2013; January 29-30, 2013. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2013/042.

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SUMMARY

A meeting of the Newfoundland and Labrador Regional Advisory Process (RAP) on the status of Capelin (*Mallotus villosus*) was held January 29-30, 2013, in St. John's, Newfoundland. Its purpose was to assess the stock status of Capelin in Northwest Atlantic Fisheries Organization (NAFO) Subarea (SA) 2 and Divisions (Div.) 3K and 3L. The previous assessment was in 2010. This proceedings report includes an abstract and summary of discussion for each working paper presented, and a list of research recommendations. The meeting terms of reference, agenda, and list of attendees are appended.

Participants at the meeting included representatives from Fisheries and Oceans Canada (DFO) Science branch, Fisheries and Aquaculture Management branch, Newfoundland and Labrador Department of Fisheries and Aquaculture, Memorial University of Newfoundland, and the fishing industry.

In addition to these proceedings, publications to come from the meeting include a Science Advisory Report (SAR) and comprehensive Research Documents, all to be available online on the DFO Canadian Science Advisory Secretariat Website.

Compte rendu du Processus de consultation régionale de Terre-Neuve-et-Labrador sur l'état du capelan dans la sous-zone 2 et dans les divisions 3K et 3L en 2013

SOMMAIRE

Une réunion du Processus de consultation régionale (PCR) de Terre-Neuve-et-Labrador sur l'état du capelan (*Mallotus villosus*) s'est déroulée les 29 et 30 janvier 2013 à St. John's, à Terre-Neuve-et-Labrador. Son objectif était d'évaluer l'état du stock de capelan dans la sous-zone 2 et les divisions 3K et 3L de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO). L'évaluation précédente a été menée en 2010. Ce compte rendu comprend un résumé et un sommaire des discussions liées à chaque document de travail présenté, de même qu'une liste des recommandations relatives à la recherche. Le cadre de référence, l'ordre du jour et la liste des participants de la réunion sont joints.

Parmi les participants à la réunion, on retrouve les représentants du secteur des Sciences du MPO, de la Gestion des pêches et de l'aquaculture, du ministère des Pêches et de l'Aquaculture de Terre-Neuve-et-Labrador, de l'Université Memorial à Terre-Neuve-et-Labrador et de l'industrie des pêches.

En plus du présent compte rendu, des publications au sujet de la réunion seront publiées, y compris un avis scientifique et des documents de recherche exhaustifs, et elles seront toutes disponibles en ligne sur le site Web du Secrétariat canadien de consultation scientifique du ministère des Pêches et des Océans.

WORKING PAPER ABSTRACTS AND DISCUSSION SUMMARIES

OCEAN CLIMATE CONDITIONS IN THE NORTHWEST ATLANTIC

Presenter: G. Maillet

Abstract

Standardized anomalies were used for most parameters in the presentation. On average there continues to be a warming phase but 2012 was a colder year. There is evidence of an advancing spring bloom and an overall trend of increasing copepod abundance since monitoring began in the 1990s.

Discussion

There was a question regarding why ocean and air temperatures appeared to do opposite things in 2012 and it was pointed out that the indices presented are based on anomalies relative to a period of reference, so though air temperatures had shifted due to the North Atlantic Oscillation (NAO), water temperatures were still above the average of the reference period. There was some discussion about possible changes to and effects of the Labrador Current. It was asked whether the cooling in 2012 may have impacted *Calanus* species typically associated with warmer conditions, the response being that these are sub-Arctic species that are well adapted to our conditions, and that all of the 2012 data has not yet been processed and it is difficult to draw conclusions at this point. It was also discussed that the C6 stage of *Calanus* has recently shown a change but the earlier life stages are not indicating the same pattern. In relation to capelin distribution and productivity, physical and biological factors have not been directly worked into analysis but will be examined.

DISTRIBUTION INFORMATION

Presenters: F. Mowbray and G. Rose

Abstract

Acoustic Surveys:

In general, over the past decade during DFO spring acoustic surveys capelin have been found in deeper waters, along the shelf break. In 2011 capelin were observed in areas of the Grand Banks where they had not been found since the late 1980s, including the south. In 2012, capelin were well distributed over the entire acoustic survey area. The distribution seems to now be concentrated more on the western portions/shallow water of the shelf, versus along the break. An opportunistic acoustic study conducted by George Rose in the spring of 2012 found high densities of capelin up the Avalon channel and in deeper inshore waters. There were very few capelin in NAFO area 3Ps, an area where they had been abundant in the late 1990s and early 2000s. In general distribution seems to be shifting further south in the spring.

Multi-Species Surveys:

Acoustic data is collected during both the fall and spring DFO bottom trawl surveys. In the fall of 2012 some of the highest capelin densities were in 2J, an area where they were historically present but where they have been very scarce in recent years. This indicates a possible northern shift in distribution in the fall.

Shrimp Fishery By-Catch:

By-catch data mirrors the findings of the acoustic data, with the highest occurrences of capelin along the shelf break and up the Bonavista corridor. In 2010 there were some high catches near the Flemish Cap, which was not captured by the acoustic survey. However, this needs to be examined more closely as the timing of the catch may be significantly different from that of the survey.

Vertical Distribution:

Vertical distribution has changed significantly since the late 1980s. Trinity Bay is one of the few locations where capelin still migrate vertically, with fish in most other areas being consistently close to the bottom since the early 1990s.

Discussion

George Rose will repeat his survey in 2013 and attempt to go further north, depending on sea conditions. There was a discussion as to whether the presence/absence of cod on the bottom may influence vertical distribution, but there is insufficient evidence to show that this occurs. In the past capelin in 2J were generally maturing, moving north in the fall, so it was questioned whether the fish in this area are currently maturing. That has not yet been looked at, but fish in that area are typically larger. It is difficult to draw conclusions from bottom trawl surveys in regards to stock composition as there are issues with catchability and vertical distribution of different sized/aged fish. It was pointed out that there seemed to be a 'hot spot' near the Flemish Cap that was consistently populated with capelin. This has not been detected in analysis and may just be an issue with the plots presented.

FISHERY INFORMATION

Presenter: B. Nakashima

Abstract

Landings in Newfoundland are much lower than those in other areas where capelin are found. The current fishery is concentrated inshore and takes place over a very short period. The TAC for capelin was reduced by 20% in 2011and this reduction was carried over into 2012. The mean length of capelin was up in 2011 and 2012 but is still smaller than historical levels, having dropped in the early 1990s. In 2009 the mean age, length and weight of capelin were the lowest in the time series.

Discussion

It was questioned why no variability around the means had been shown and whether there is a lot of spatial heterogeneity in capelin size. The variation is quite small and the fishery is short so, in general, samples are quite uniform. It was also asked if the change in mean length was a result of the change in age structure, or length at age. The response was that it is probably driven by change in age structure, especially due to variation in the proportion of age 2's which have not shown as much variation in length as have ages 3 and 4. An industry representative commented that in 2012 there was a large range in capelin weight in Conception Bay but not in any other areas; as the 2012 samples have not yet been processed no comment could be made about this by science. Because capelin weights can change dramatically during spawning, the assessment focuses on lengths. A discussion took place regarding the current management of the stock. Industry representatives felt strongly that the decline seen in the 1990s was not due to overfishing, as declines also occurred in areas with very little removals. It was commented that discarding is likely substantially lower than it was in the past, as there is no longer a preference for females and daily limits have been implemented.

BIOLOGICAL INFORMATION

Presenters: F. Mowbray, B. Nakashima

Abstract

Spawning Times:

In general spawning has been anywhere from 3-4 weeks later since 1991. Spawning was protracted in 2011 and 2012. Egg deposition has gone down in recent years, after 2010 this parameter was no longer monitored.

Size and Age Structure:

The acoustic survey was designed to target age 2's and they have dominated the catch throughout the series. In the 2000s larger proportions of age 2's have been maturing, whereas they were typically immature in the past. Spatial segregation of fish by age is typically seen in the survey. In recent years there have been higher numbers of age 1's, it is unclear whether this is due to a true change in proportion or accessibility to the survey. Age 1's can be difficult to catch in the net during the survey and to differentiate acoustically. However, with new equipment upgrades in 2012 differentiation may no longer be as big of an issue, as it may now be possible to determine both species and size acoustically. The length at age of 1's and 2's has gone up, while older fish are now smaller.

Feeding:

Calanus sp. copepods dominate the diet of offshore capelin, with Trinity Bay being the exception where euphausids compose the majority of the diet. In 2012 the largest size class had the lowest stomach fullness, but it is unsure what caused this. Body condition has improved in the past two years and is positively correlated with the abundance of some zooplankton, particularly calanoid copepods and hyperiids.

Discussion

It was asked what the variability was in peak spawning and if it was easily defined. The response was that on smaller beaches there is usually a single spawning event, but at Bellevue there are usually 3-5 distinct spawning waves, lasting a period of days. There was a discussion as to what the difference in size and condition was for virgin versus repeat spawners. This has not been investigated specifically but whether fish are maturing or not they are still smaller than in the 1980s. With such high mortality of spawners it would be difficult to test this further. It was questioned if the proportion of age 2 fish maturing showed a pattern, and if there is a known minimum size of maturation. It is thought that maturation is a density dependent function that is mediated by growth, but a variety of parameters are definitely influencing current patterns in maturity. It was also asked if younger fish are in general doing better than older/larger fish. This does seem to be the case when looking at stomach fullness, but there may be confounding factors with the data series that make that conclusion doubtful.

ABUNDANCE

Presenter: F. Mowbray

Abstract

The acoustic survey provides an index of abundance within the surveyed area only. Offshore abundance has improved in 2011 and 2012. Distribution patterns, age composition and age at

maturity are all shifting back slightly towards those levels seen during the period of high abundance in the late 1980s.

Discussion

There was a discussion about survey design and it was noted that this is described in detail in the 2011 research document. The rationale for using stratification was also explained, as the biological characteristics and abundance of capelin can vary across the survey area and there is a need to adequately sample the population. It was asked if there was any information on specific bays other than Trinity Bay. Generally there is not, as the only other source of data is the bottom trawl survey which largely takes place offshore. There was a discussion about the crash in 1991 and if it was indeed as dramatic as it appears, representatives from both Science and industry agreed that this did seem to be the case. There was a question regarding the capelin being distributed on the bottom and potential issues with acoustics. This has rarely been an issue and is not thought to be a serious problem, though there can be instances when fish go undetected.

RECRUITMENT

Presenters: F. Mowbray, B. Nakashima

Abstract

Spawning was contracted in 2012, with low demersal spawning; the opposite occurred in 2011. The most significant disagreement between beach and surface larval tows occurred in 2010. Beach tows will be discontinued as of 2013. The Trinity Bay larval survey had the lowest numbers of the time series for both August and September in 2012.

Discussion

It was asked whether any corrections were made to the indices to account for anomalies such as wind, the response being that none were made. There was a discussion about projecting the larval index forward to see if it predicts future abundance. When there was biomass/year class strength a model showed that wind events had the largest impact on recruitment off the beach. In recent times there were no biomass estimates so confirming the larval index has been difficult. There is a graph of cohorts that shows the larval index tracks fairly well with the offshore acoustic index, but this could be better represented and compared with age 3's as well. There was a comment from an industry representative that spawning was observed early (late June) in Bonavista Bay and Outer Cove in 2012. It was asked if it was possible that some larvae coming off the beaches were missed by the survey; the response being that this is possible and that in 2012 the length frequencies showed a mode of smaller fish; it could be that larger fish had already spawned and left the area before the work in Bellevue began.

SEABIRD AND CAPELIN INTERACTIONS

Presenter: W. Montevecchi

Abstract

The diet of common murres and Northern gannets was sampled in late June and early August, during chick rearing. Capelin is the key prey, making both species useful 'samplers' of capelin. Gannet diet showed a shift to cold water species in the 90's, then back to warm water fish in 2005. In recent years there has been an increasing proportion of sandlance in the gannet diet. Murres seem to show a preference for female capelin and this could mean that a mismatch in spawning times and chick hatching have negative impacts on chick condition. Murre fledgling mass was high in 2012. When the mean size of capelin is down, murres seem to bring back larger fish, demonstrating a potential size preference.

Discussion

It was observed that gannets switched to a diet largely consisting of capelin right after the capelin crash in the early 1990s. It was then questioned why they were not selecting for capelin when they were abundant, the response being that gannets prefer 'warm water pelagics' by far, in particular mackerel which were more abundant in the 1980s. It was also observed that capelin spawning was earlier in the 1980s, potentially limiting availability to seabirds. It was asked if murres were capturing more large fish due to size selective schooling, however this would be difficult to determine. There was some discussion about sandlance and their increase in seabird diets. A fisher commented that recently large numbers of sandlance had been observed in the crab fishery. A general observation was made that 2012 was a very bizarre year for seabirds with high chick abandonment by gannets, which may be warm water related – though gannets prefer warm water pelagics.

REPRODUCTION - A SYNOPSIS OF SOME NEW (AND SURPRISING) RESEARCH ON CAPELIN REPRODUCTION

Presenter: C. Purchase

Abstract

When hatched at different salinities, capelin larvae actually did better in salinities lower than that of seawater. Hatching was faster at higher temperatures, and lower salinities. The warmer the water, the faster larvae died of 'starvation.' In general, high salinity prevents hatching and then kills larvae quicker; survival was relatively low at high salinities. It was also found that capelin sperm die quickly and swim more slowly in saltwater.

Discussion

There was a discussion about demersal spawning sites in regards to salinity. There are no salinity loggers on these sites, but will be soon. Many smelts only spawn in areas with groundwater seeps and though it would be extremely difficult to quantify, suspect that may be the case for demersal spawners. There also seems to be dramatic selective power and it could be that other populations are better adapted to spawning at high salinities (local adaptations). It is possible that when fish go to the beach they have a very limited time frame to spawn successfully, as results of this work also indicated decreasing egg quality with decreasing fish condition. It does seem that many 'good' capelin beaches have freshwater inflow, this may be something to look at geographically.

CAPELIN PREDATORS AND CONSUMPTION

Presenter: F. Mowbray (for M. Koen-Alonso)

Abstract

There was a collapse of most of the fish community in the late 1980s and early 1990s in the NL large marine ecosystem; the exceptions were benthivorous fish, and especially shellfish whose biomass increased significantly. There have been some increases in species abundance during the 2000s but this seems to have stalled after 2007; shellfish has also declined significantly since 2007. There was an increase in the proportion of capelin in the diet of cod, turbot and American place in 2011. The southern region (3N) redfish also showed evidence of consumption of capelin.

Models show significant consumption of capelin by harp seals, with large increases over the past 20 years. The abundance of forage species in fall bottom trawl surveys has shown a slight increase in Arctic cod and capelin in recent years.

Discussion

It was observed that individual piscivores aren't necessarily eating more capelin, but rather their consumption has increased in conjunction with their abundance. While this is true, the diet data for seals shows that a considerable proportion of the seal diet in offshore areas is comprised of capelin. However, there is considerable uncertainty around the mean estimates. There was a comment that the consumption of capelin by seals should be compared to the estimated capelin biomass. This comparison should be made against capelin production instead of biomass as consumption results from production.

ENVIRONMENTAL EFFECTS ON HERRING STOCK COMPOSITION

Presenter: C. Bourne

Abstract

Herring in Newfoundland have traditionally been spring spawning fish, with a small component of the stocks spawning in autumn. In the past decade there has been a steady increase in the proportion of autumn spawning herring, as well as the recruitment of autumn spawners. A similar shift in stock composition has been observed in other areas in the Northwest Atlantic and Melvin et al. (2009) proposed that temperature change could be a proxy for changes in stock composition. Increasing mean annual temperatures were significantly correlated with increasing autumn spawner recruitment in NL, as were increases in a composite physical oceanography climate index that reflects changes in temperature. The onset of spring spawning was positively correlated with annual ice extent, suggesting coordination with the spring phytoplankton bloom.

Discussion

A harvester wished to know if there had been any recent work on herring migration as changes in inshore ice seems to have impacted stock distribution. To date no work has been done with tagging but samples have been taken during multispecies offshore trips in an effort to obtain more distribution data. There was some discussion about whether herring would now be managed as separate stocks within stock areas (spring vs fall); this will be decided at the upcoming framework meeting. A question was asked about a possible genetic basis for spawning type. This is currently being investigated by a graduate student at Dalhousie University. A harvester inquired if the herring that were caught in the summer were considered spring or fall spawners. Officially July 1 is the cut off for distinguishing spawning type (before is spring, after is autumn); it is suspected that much of the spawning occurring in the summer is from autumn spawners. There was a brief discussion regarding growth rates and sizes at maturity. There are currently no data to support differential growth rates between stock components, and that the size at 50% maturity may have changed but is still being investigated. There was an inquiry about work being done on larval herring in Newfoundland; no such work has been done in recent years. There was a discussion about the Research Gill Net Program and cuts that will occur in 2013. Industry representatives were concerned about a loss of scientific data and impacts on the fishery. It was questioned if there was a time when herring should not be fished, but without current data on migration that is difficult to say.

FINAL DISCUSSION (GENERAL/REVIEW)

There was some discussion by harvesters about gear type regarding tuck seines and traps. In some parts of Trinity Bay traps are still being used, probably the only bay that still has high trap activity. One reason for the shift to tuck seine is the vertical distribution of capelin shifting toward the bottom.

There was a question about where the assessment was going in terms of the determination of stock status and how it will feed into providing advice for managers. It was proposed by a DFO scientist that the stock is in the critical zone and there should be no directed fishing. The stock lead commented that the stock is low, but without reference points it is difficult to quantify. A discussion ensued regarding the potential of closing the fishery, with harvesters stating that to them there were positive signs in recent years and felt that a closure was unfounded. This led to further discussion on the time frame in which stock status should be considered, i.e. should recent numbers be compared to the entire time series, including the high abundance on the 1980's, or only the 'post collapse' period after 1991. It was recommended that if a regime shift can't be proven assessments should continue to compare current levels to those 'pre collapse' and make management recommendations based on that comparison and that the general scientific consensus for forage species is that extra caution should be taken with management as they help build all other stocks. The conclusion of the discussion was that there is a need to develop reference points for capelin (see research recommendation).

Comments were made by harvesters regarding the impacts of seals potentially being far greater than those of the fishery on capelin stocks and that management of the seal population should be a priority.

RECOMMENDATIONS

Develop reference points in consultation with industry and managers that could apply to the 2J3KL capelin stock, with priority being the establishment of the limit reference point. It was noted that this recommendation should be a priority

Harp seals are one of the predators on capelin and based on their large abundance, their dietary requirement should be considered at the next RAP.

The pelagic section should develop more expertise in reading capelin otoliths instead of relying on a single age reader.

The recent fall acoustic data from the bottom trawl survey shows promise in establishing a more comprehensive fall capelin distribution map and in providing a synoptic index of capelin abundance. The analysis of data collected needs to be expedited.

Every effort should be made to present the potential value of the above information being collected, in particular for capelin and in general for forage species, in a timely manner.

REFERENCES CITED

Melvin, G.D., Stephenson, R.L. and Power, M.J. 2009. Oscillating reproductive strategies of herring in the western Atlantic in response to changing environmental conditions. ICES J. Mar. Sci. 66(8): 1784-1792.

APPENDIX 1. TERMS OF REFERENCE: REGIONAL ADVISORY PROCESS (RAP) DFO, NEWFOUNDLAND AND LABRADOR REGION CAPELIN (SUBAREA 2 + DIV. 3KL)

Terms of Reference

Regional Advisory Process (RAP) DFO, Newfoundland and Labrador Region Capelin (Subarea 2 + Div. 3KL) January 29 – January 30, 2013 - St. John's NL

Chairperson: Earl Dawe, Aquatic Resources Division, Science Branch, DFO, NL Region

Context

The status of capelin in Subarea 2 + Div. 3KL was last assessed in 2010, refer to Science Advisory Report 2010/090; and Proceedings 2011/024. The current assessment is requested by Fisheries and Aquaculture Management to provide the Minister with detailed advice on the status of this stock

Objectives

A review of information available concerning the status of Subarea 2 + Div. 3KL capelin as follows:

- Information on historical catches up to and including the 2012 fishery.
- Trends in abundance from the spring acoustic survey, egg and larval studies
- Behavioural information on occurrence, distribution, and spawning times.
- Biological information on sizes, ages and maturities.
- Review of capelin feeding and condition
- Recent changes in predator field
- Review of potential larval recruitment indices
- Information on environmental influences on the recruitment of other pelagic forage fish (Atlantic Herring).

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document(s)

Participation

- DFO Science, Newfoundland and Labrador and Maritimes Regions
- DFO Fisheries and Aquaculture Management, Newfoundland and Labrador Region
- Industry Representatives
- Aboriginal Groups
- Non-Governmental Organizations
- Fish, Food and Allied Workers Representatives
- Provincial Department of Fisheries and Aquaculture
- Memorial University of Newfoundland

APPENDIX 2. AGENDA: REGIONAL ADVISORY PROCESS (RAP) DFO, NEWFOUNDLAND AND LABRADOR REGION CAPELIN (SUBAREA 2 + DIV. 3KL)

Agenda

Tuesday, January 29

Time	Topic	Presenter
9:00 – 9:30	Introduction	E. Dawe (Chair)
9:30 – 10:00	Environmental Overview	G. Maillet
10:00 – 10:30	Distribution Information • Acoustic surveys • Bottom trawl surveys • Shrimp by-catch	F. Mowbray/ G. Rose
10:30 – 10:45	*Refreshment Break*	
10:45 – 11:00	Fishery • Landings, catch characteristics	B. Nakashima
11:00 – 11:30	Biological Information • Spawning times • Size and age structure: Spring acoustic survey • Maturation, condition, and feeding	B. Nakashima/ F. Mowbray
11:30 – 12:00	Abundance Div. 3L Spring acoustic survey	F. Mowbray
12:00 – 1:00	*Lunch (Not Provided)*	
1:00 – 1:45	Recruitment • Bellevue Beach • Trinity Bay • Acoustic survey • Comparison of indices	B. Nakashima/ F. Mowbray
1:45 – 2:15	Seabirds	B. Montevecchi
2:15 – 2:45	Reproduction – a synopsis of some new (and surprising) research on capelin reproduction	C. Purchase
2:45 – 3:00	*Refreshment Break*	
3:00 – 3:30	Capelin predators and consumption	M. Koen-Alonso
3:30 – 4:00	Environmental Effects on Herring Stock Composition	C. Bourne

Wednesday, January 30

Time	Topic	Presenter
9:00 – 10:00	Unfinished Discussions / Additional Items	E. Dawe (Chair)
10:00 – 10:30	Research Recommendations	F. Mowbray
10:30 – 10:45	*Refreshment Break*	
10:45 – 12:00	Drafting of SAR Summary Bullets	B. Nakashima
12:00 – 1:00	*Lunch (Not Provided)*	
1:00 – 2:15	Drafting of Other SAR Sections • Sources of uncertainty • Stakeholders perspectives	B. Nakashima
2:15 – 2:30	Conclusions and Advice	F. Mowbray

APPENDIX 3. LIST OF ATTENDEES: REGIONAL ADVISORY PROCESS (RAP) DFO, NEWFOUNDLAND AND LABRADOR REGION CAPELIN (SUBAREA 2 + DIV. 3KL)

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